

Development of Model Execution and Documentation Capabilities for the Earth System Grid

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Don Middleton & Luca Cinquini
*National Center for Atmospheric Research
Computational and Information Systems Lab
Technology Development Division*



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Gateways for ESG, and more

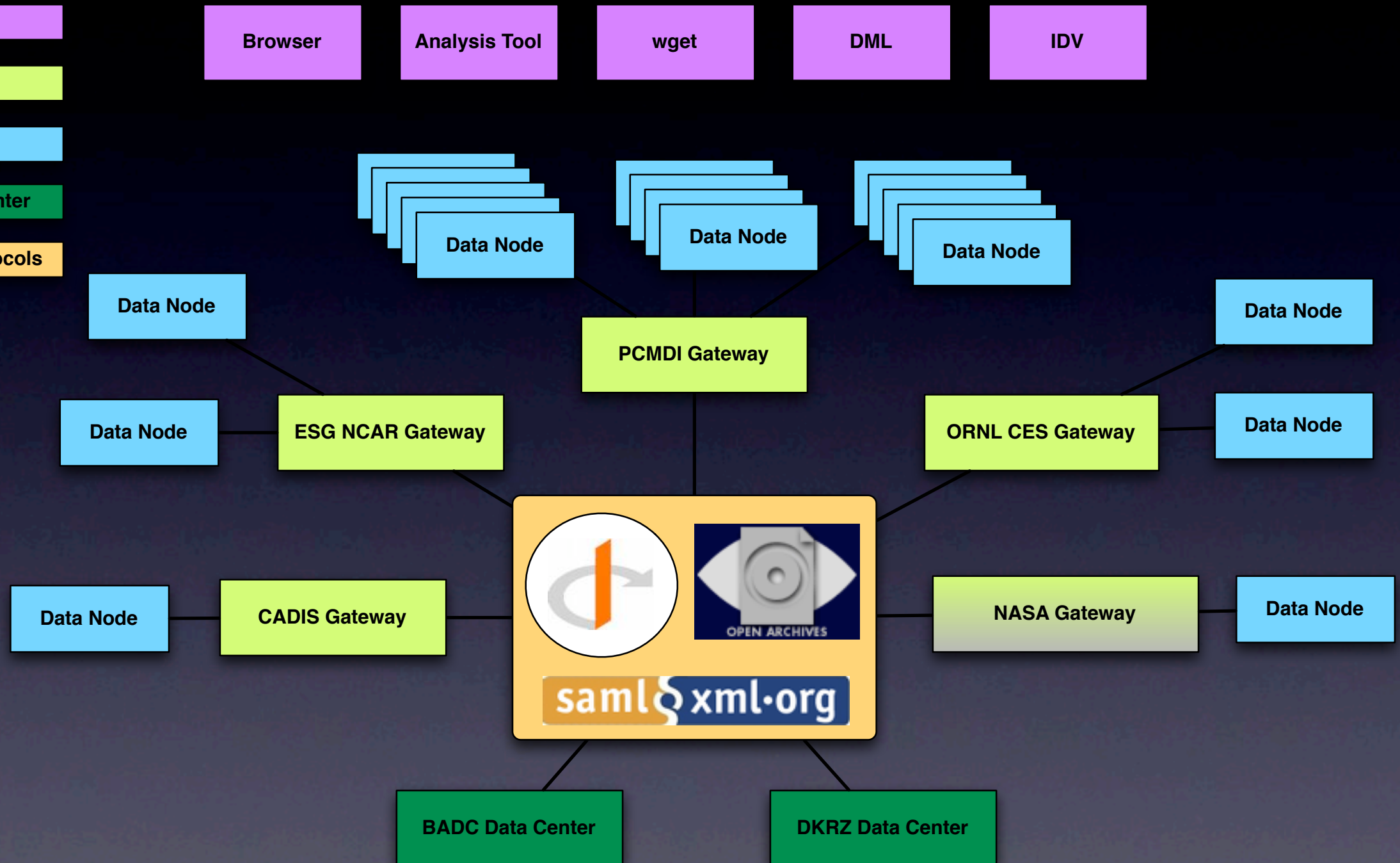


Diagram Courtesy of Luca Cinquini (NCAR)



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ESG Gateway (alpha)

ESG-NCAR Gateway

http://esg.prototype.ucar.edu/home.htm

BaseCamp FB Google IMDB VETSblog Events Feeds (1235) InBox NCAR News Personal Projects and Proposals WeatherTravel Comcast Resources


ESG-NCAR Gateway

Earth System Grid

Home Data About ESG-NCAR Account Login

ESG Gateway at the National Center for Atmospheric Research

The Earth System Grid



The Earth System Grid (ESG) integrates supercomputers with large-scale data and analysis servers located at numerous national labs and research centers to create a powerful environment for next generation climate research. Access to ESG is provided through a system of federated Data Gateways, that collectively allow access to massive data and services for Climate Global and Regional Models, IPCC research, and analysis and visualization software. The Earth System Grid - Center for Enabling Technologies (ESG-CET) is funded by the U.S. Department of Energy as part of the SciDAC (Scientific Discovery through Advanced Computing) program. [Read More](#)

Data Gateways

- ESG-NCAR (Climate)
- ESG-PCMDI (IPCC AR4)
- CADIS (Arctic)
- CDP (Community)

Quick Links

- Create Account
- Browse Catalogs
- Search for Data
- Visualize Data
- Download NCL
- Register for NCL Access

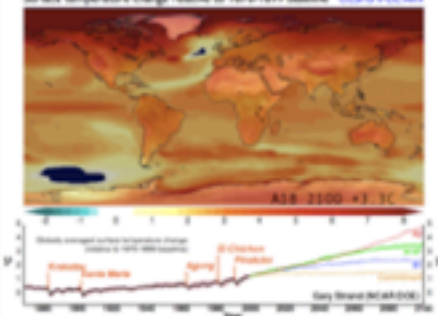
Quick Data Search

[Advanced Search](#)

Browse by Project **Browse by Experiment** **Browse by Topic**

- Community Climate System Model (CCSM)
- North American Regional Climate Change Assessment Program (NARCCAP)
- NCAR Command Language (NCL)
- Parallel Climate Model (PCM)

Spotlight: CCSM-3 Model



Surface temperature change relative to 1870-1899 baseline. CCSM3 SRES A1B

The graphic depicts the surface temperature increase (relative to the 1870-1899 period) from the average of a set of CCSM3 experiments of the IPCC AR4 SRES A1B (midrange) climate change scenario. [Learn More](#)

Home | Data | About ESG-NCAR | Account | Login



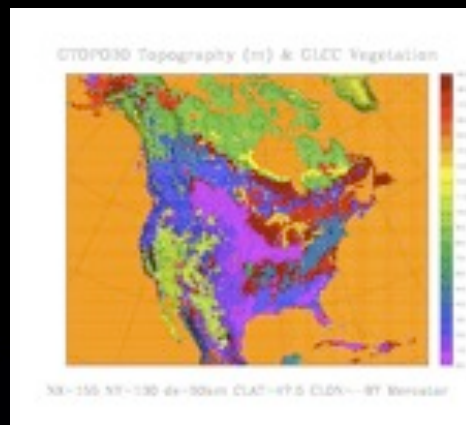


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The Earth System Grid
(Climate/IPCC,
DOE+NSF)



NARCCAP
(Regional Climate:
NSF, DOE, NOAA)



Cooperative Arctic Data
and Information Service
(Polar, NSF)



NCAR's Community
Data Portal



Earth System Curator
(Models+Data, NSF)



TIGGE
(Ensemble weather)



NSF
TeraGrid

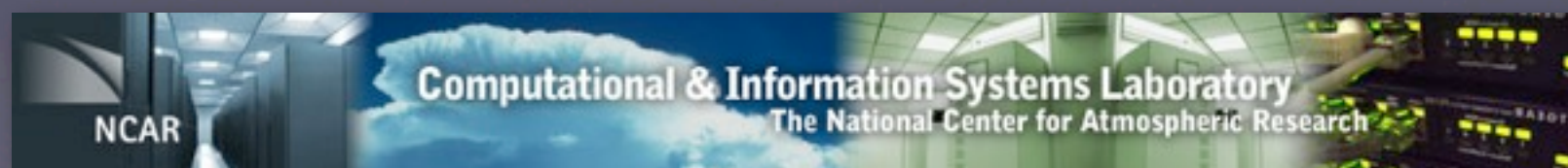


WMO-WIS
(Global Federation)

Science Gateway Framework (SGF, in development)



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Information Integration Across Models, Data, and Knowledge



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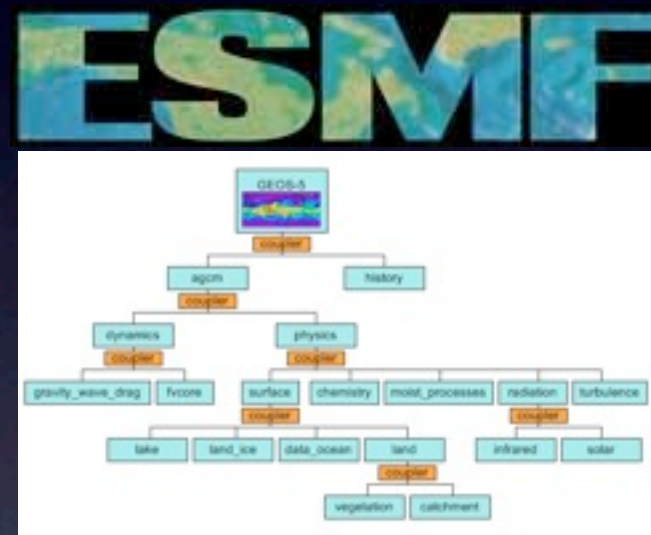
Information Integration Across Models, Data, and Knowledge



NCAR



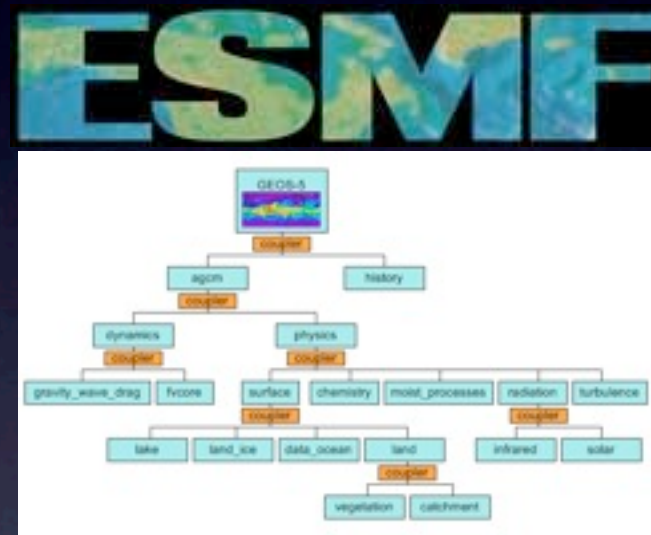
Information Integration Across Models, Data, and Knowledge



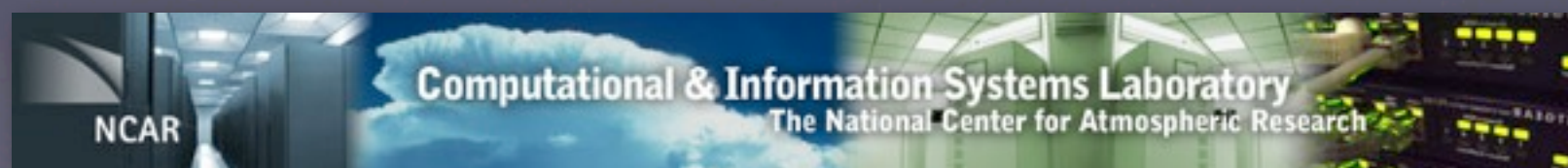
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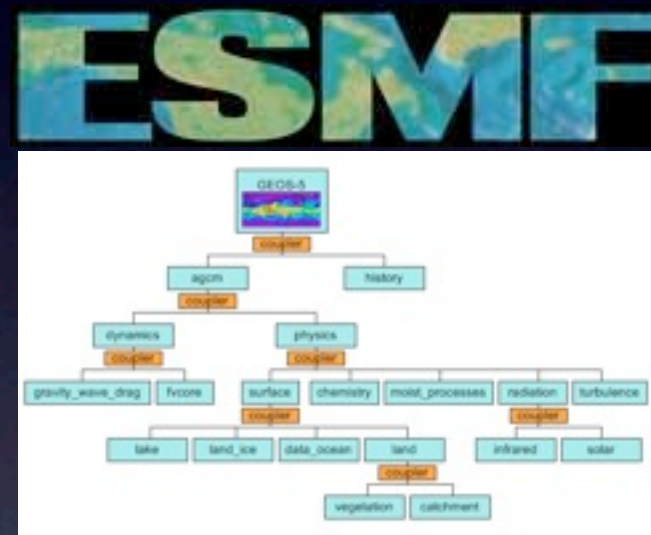
Information Integration Across Models, Data, and Knowledge



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Information Integration Across Models, Data, and Knowledge



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“Trackback” Interfaces

ESM2M Control-1990 dyn_veg warmbrdf Simulation

Full Name: Earth System Model Version 2 Modular Ocean Model 4 Dynamic Vegetation Warm Bidirectional Reflection Distribution Function

Description: Simulation to arrive at the initial conditions for CMIP5 Experiment 3.1



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“Trackback” Interfaces

The screenshot shows a web browser window titled "Resource Metadata" with the URL http://curator.ucar.edu/query/queryResultsSync.htm?id=esg%3amodel_gfdl_cm3&session=true. The browser's address bar also shows a Google search bar. The page features a navigation bar with links: Home, Data, About ESG, Account, and Login. Below the navigation bar, the page is titled "Resource Metadata" and includes a "BACK TO SEARCH" link. The main content area displays "GFDL Climate Model 3" with the full name "Geophysical Fluid Dynamics Laboratory Climate Model 3" and a description "Example model from GFDL". A tabbed interface shows "Properties", "Components", and "Grids". The "Grids" tab is active, displaying a list of grid descriptions. The first section is "GFDL FV Cubed Sphere Atmospheric C48 Model Mosaic", which includes a "Grid Type: Cubed gnomonic", "Congruent Tiles: True", and "Number of Grid Tiles: 6". Below this are six individual tiles: "GFDL FV Cubed Sphere Atmospheric C48 Model Tile 1" through "GFDL FV Cubed Sphere Atmospheric C48 Model Tile 6". The second section is "GFDL Land Model 2 Mosaic", which includes "GFDL Land Model 2 Tile". The third section is "GFDL MOM4 P1 Mosaic", which includes "Grid Type: Tripolar" and "GFDL MOM4 P1 Tile". At the bottom of the page, there is a navigation bar with links: Home | Data | About ESG | Account | Login, and a user status "User: guest".



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“Trackback” Interfaces

The screenshot shows a web browser window titled "Resource Metadata" with the URL http://curator.ucar.edu/query/queryResultsSync.htm?id=esg%3amodelcomponent_csu_dycore&session=true. The browser's address bar and search bar are visible. The page features a header with the "Earth System Grid" logo and navigation links: Home, Data, About ESG-NCAR, Account, and Login. Below the header, the "Resource Metadata" section displays the "CSU Dynamical Core" with a "Full Name:" and "Description:" field. A "BACK TO SEARCH" link is located in the top right corner. The main content area is divided into "Properties" and "Components" tabs. The "Properties" tab is active, showing a list of properties and their values. The "Scientific" sub-tab is selected, displaying the following table:

| Property | Value |
|------------------------------------|---|
| Numerical Methods | |
| Equations of Motion | Hydrostatic Shallow atmosphere |
| Numerical Method | Finite difference |
| Spatial Approximation | None |
| Advection Scheme | 3rd order upstream |
| Conservation Type | Mass Tracer mass Vertical Advection |
| Conservation Fixers (A Posteriori) | None |
| Time Stepping | Explicit |
| Temporal Approximation | 3rd-order Adams-Bashforth |
| Inherent Spatial Diffusion | Horizontal hyper-diffusion of Divergence |
| Implicit Diffusion | Monotonicity constraint |
| Explicit Spatial Filter | None |
| Diagnostic Variables | Stream function U-velocity V-velocity Velocity potential Vertical mass flux |
| Prognostic Variables | Divergence |

Below the table, there are expandable sections for "Coordinate System" and "Tracers".



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Semantic Integration

The screenshot shows the ESG Advanced Search interface in a web browser. The browser address bar shows the URL <http://esg-cet.ucar.edu/query/queryESG-3.htm>. The page has a header with the "Earth System Grid" logo and navigation links: Home, Data, About ESG, and Login. Below the header, there are links for Collection Browsing, Simple Search, Power Search (1), Power Search (2), and Data Visualization.

The main section is titled "Advanced Search". It includes instructions: "Instructions: Use the categories below to create a search hierarchy. Search results will be filtered from left to right by each option selected within each category. Rearrange the categories to change the search hierarchy."

Below the instructions, there is a "Search Categories" section with buttons for Model, Experiment, CF Standard Name, Time Frequency, Data Format, Domain, and Grid. The "Model" category is selected, and its options are displayed in a list: Model, Model > CCSM 3, and Model > PCM 1. The "Experiment" category is also selected, and its options are displayed in a list: IPCC AR4 and IPCC AR4 > IPCC AR4 PCentri. The "CF Standard Name" category is selected, and its options are displayed in a list: air pressure at sea level, air temperature, atmosphere cloud condensed water, atmosphere cloud ice content, atmosphere water vapor content, cloud area fraction, cloud area fraction in atmosphere, convective cloud area fraction in z, and convective precipitation flux.

Below the search categories, there is a "Free Text" search box. Below the search box, there are buttons for "Reset All Categories", "Reset All Options", and "Submit Query".

The search results section shows "Total Number of Results: 1" and "1-1 of 1 results". The first result is listed as:

1. [CCSM run b30.009: atmospheric post-processed data, monthly averages](#)
Description: CCSM 3.0 1990 control run, resolution: T85_gx1v3
Authorization: Guest Users
Access: [Data Visualization \(LAS\)](#)

At the bottom of the results section, there is a footer with the text: "User: guest | [ESG Home](#) | [Contact Us](#)
Gateway Portal Software version 0.2 © UCAR, all rights reserved."



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Some Focus Areas

- Continued collaboration across GLP, Curator, METAFOR, and ESG, in pursuit of CMIP5 objectives
- Dynamic comparison tables of model and component properties
- Building upon extremely rich metadata, exploit semantic capabilities
- User and group workspaces



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Model Execution Capabilities

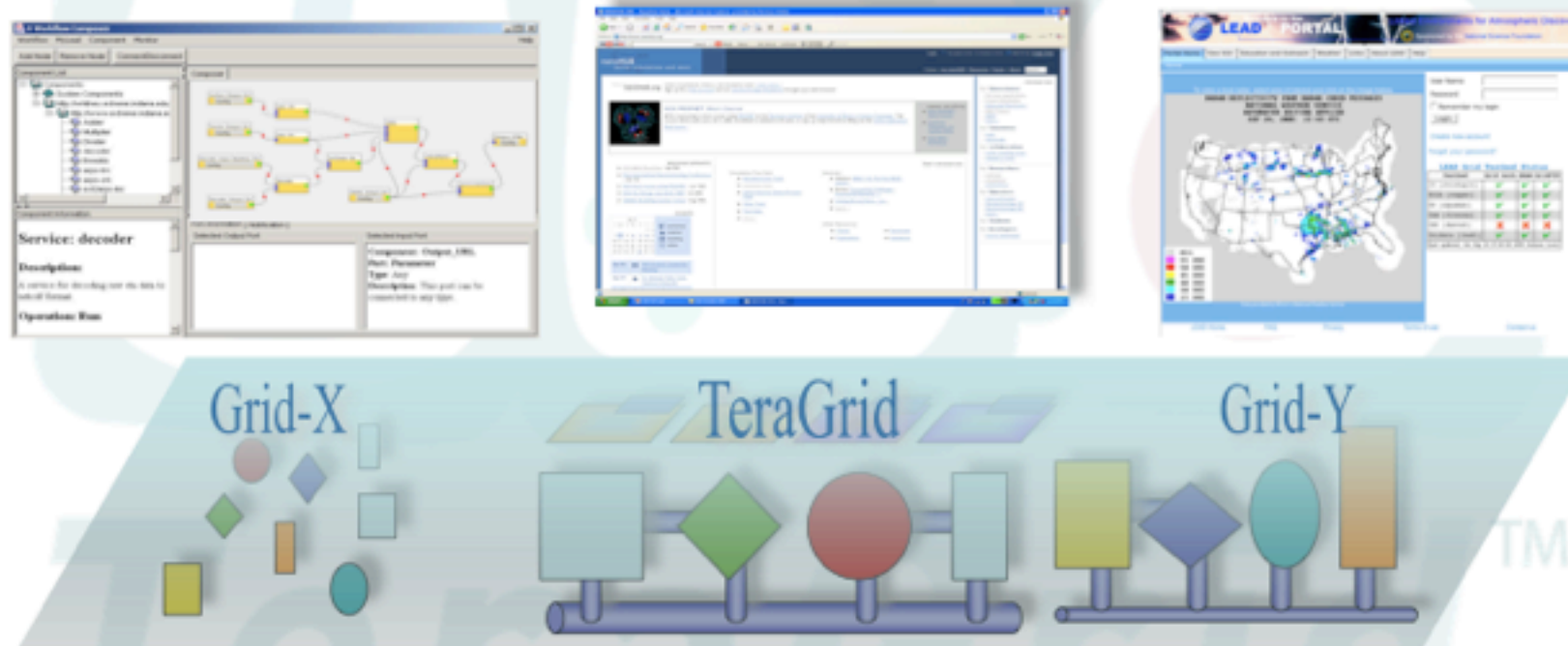


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Science Gateways

TeraGrid Science Gateways Initiative: Human Interface to Grids



- **Common Web Portal or application interfaces** (database access, computation, workflow, etc).
- **“Back-End” use of TeraGrid computation, information management, visualization, or other services.**
- **Standard approaches so that science gateways may readily access resources in any cooperating Grid without technical modification.**

Charlie Catlett (cec@uchicago.edu)

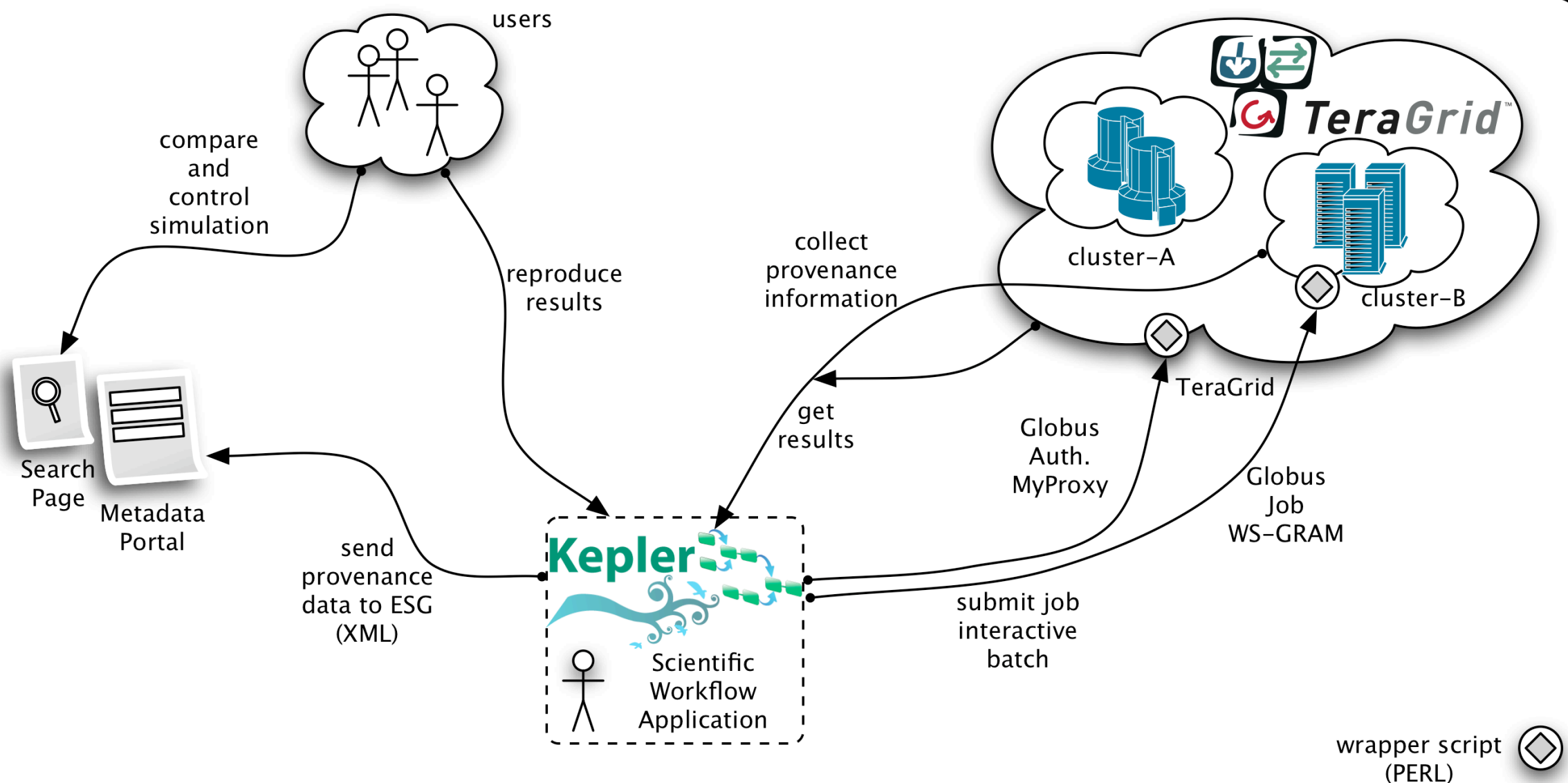
May 2006 TeraGrid[®]



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A Prototype CCSM Workflow on the TeraGrid



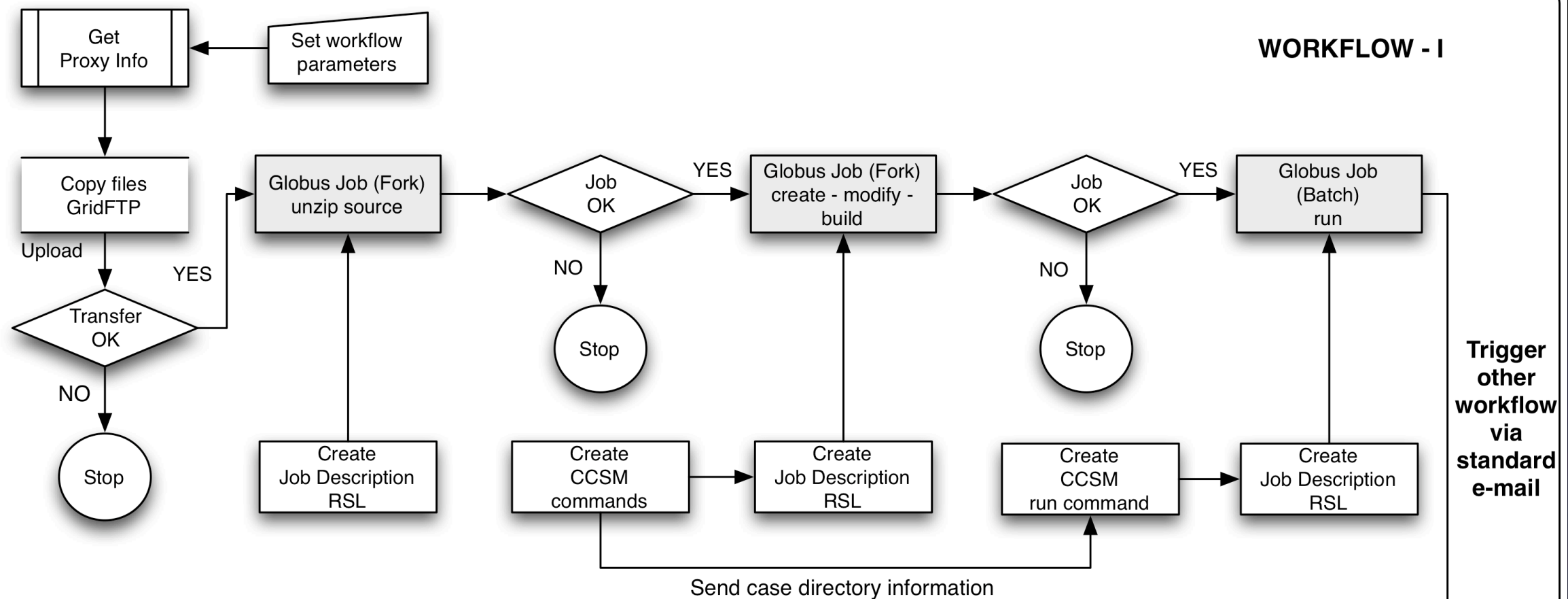
Material Courtesy of Ufuk Turuncoglu, Sylvia Murphy, and Cecelia DeLuca



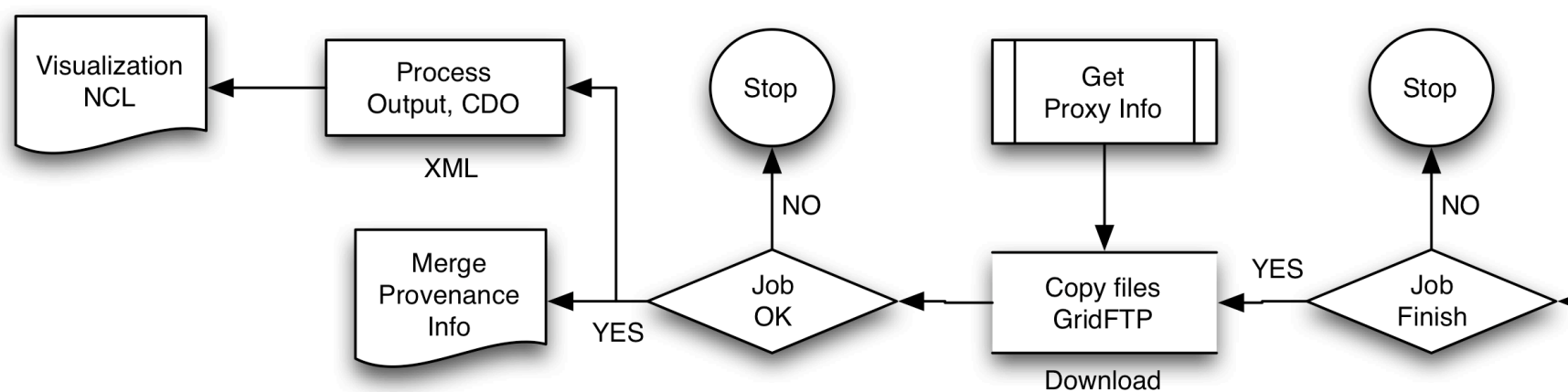
NCAR



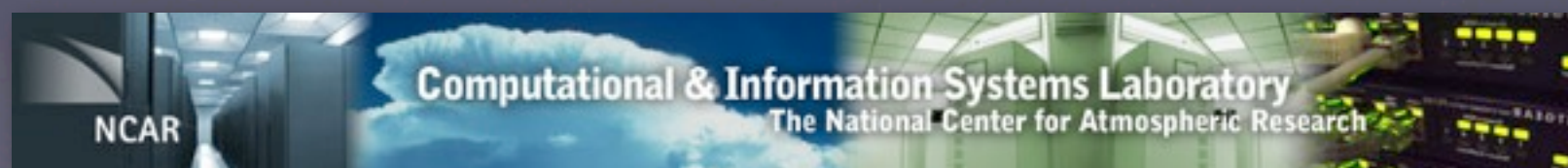
WORKFLOW - I



WORKFLOW - II



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Some Focus Areas

- Develop generalized multi-model workflows, addressing configuration, execution, and data/metadata publication
- Coordinate with the Analysis Workflows thrust in GLP
- Collaborate with the TeraGrid Science Gateways initiative and Purdue



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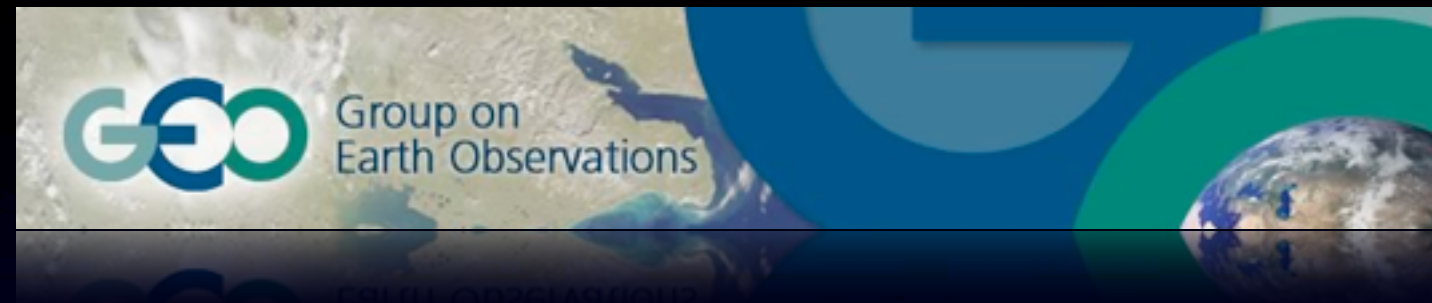
Future Possibilities



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Towards Global Data Federation



World Meteorological Organization

A United Nations Specialized Agency • Working together in weather, climate and water

 **Digital**PRESERVATION

National Digital Information Infrastructure & Preservation Program:
A Collaborative Initiative of the Library of Congress

Google
Earth

 **Global Change Master Directory**
Discover Earth science data and services

Shared
Cyberinfrastructure



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Open Access





Knowledge in Publications

- Open Access Trends
- Citable Datasets
- Linking models, data, and knowledge from scholarly works



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End

don@ucar.edu



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